

Claims

- [c1] 1. An automotive headlamp comprising:
a housing for receiving a light source;
a light source received in the housing;
an outer lens affixed to the housing and disposed such that light from the light source received in the housing passes through the lens;
wherein the lens comprises a polycarbonate and a photoluminescent material and the headlamp is compliant with the beam photometry and beam chromaticity requirements defined in the SAE standards for automotive headlamps; and
wherein the light source and the material of the lens are selected such that light emitted from the light source is modified in chromaticity as it passes through the lens such that the illuminating beam from the headlamp has an average x chromaticity coordinate of 0.345 to 0.405.
- [c2] 2. The headlamp of claim 1, wherein the photoluminescent material comprises an organic fluorescent dye.
- [c3] 3. The headlamp of claim 2, wherein the lens material further comprises a non-fluorescent dye.

- [c4] 4.The headlamp of claim 3, wherein the fluorescent dye is included at a concentration of 0.0001 to 1 weight % of fluorescent dye and the non-fluorescent dye is included at a concentration of 0.00001 to 0.1 weight % of non-fluorescent dye.
- [c5] 5.The headlamp of claim 3, wherein the fluorescent dye is included at a concentration of 0.005 to 0.5 weight % of fluorescent dye and the non-fluorescent dye is included at a concentration of 0.0001 to 0.01 weight % of non-fluorescent dye.
- [c6] 6.The headlamp of claim 2, wherein the fluorescent dye is selected from the group consisting of perylene derivatives, anthracene derivatives, benzoxazole derivatives, stilbene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphthalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, (2,5-bis[5-tert-butyl-2-benzoxazolyl]thiophene) and derivatives or combinations thereof.
- [c7] 7.The headlamp of claim 1, wherein the light source is selected from the group consisting of:
a high intensity gas discharge light source,
a solid state light source,
a standard halogen light source, and
a halogen infrared reflected light source.

- [c8] 8.The headlamp of claim 7, wherein the light source has an average x chromaticity coordinate of greater than 0.405.
- [c9] 9.The headlamp of claim 7, wherein the photoluminescent material comprises an organic fluorescent dye.
- [c10] 10.The headlamp of claim 9, wherein the lens material further comprises a non-fluorescent dye.
- [c11] 11.The headlamp of claim 10, wherein the fluorescent dye is included at a concentration of 0.0001 to 1 weight % of fluorescent dye and the non-fluorescent dye is included at a concentration of 0.00001 to 0.1 weight % of non-fluorescent dye.
- [c12] 12.The headlamp of claim 10, wherein the fluorescent dye is included at a concentration of 0.005 to 0.5 weight % of fluorescent dye and the non-fluorescent dye is included at a concentration of 0.0001 to 0.01 weight % of non-fluorescent dye.
- [c13] 13.The headlamp of claim 12, wherein the light source has an average x chromaticity coordinate of greater than 0.405.
- [c14] 14.The headlamp of claim 10, wherein the fluorescent dye is included at a concentration of 0.01 to 0.25 weight

% of fluorescent dye and the non-fluorescent dye is included at a concentration of 0.001 to 0.01 weight % of non-fluorescent dye.

[c15] 15.The headlamp of claim 14, wherein the light source has an average x chromaticity coordinate of greater than 0.405.

[c16] 16.The headlamp of claim 9, wherein the fluorescent dye is selected from the group consisting of perylene derivatives, anthracene derivatives, benzoxazole derivatives, stilbene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphthalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, (2,5-bis[5-tert-butyl-2-benzoxazolyl]thiophene) and derivatives or combinations thereof.

[c17] 17.The headlamp of claim 7,
wherein the light source is a halogen infrared reflected light source;
wherein the light source has a low beam output and an high beam output;
wherein the low beam output is greater than or equal to 980 lumens and the high beam output is greater than or equal to 1180 lumens;
wherein the headlamp has a low illuminating beam output and a high illuminating beam output; and

wherein the low illuminating beam output is greater than or equal to 430 lumens and the high illuminating beam output is greater than or equal to 680 lumens.

[c18] 18.The headlamp of claim 17,
wherein the low beam output is greater than or equal to 1280 lumens and the high beam output is greater than 1500 lumens; and
wherein the low illuminating beam output is greater than or equal to 480 lumens and the high illuminating beam output is greater than or equal to 730 lumens.

[c19] 19.The headlamp of claim 17,
wherein the low beam output is greater than or equal to 1480 lumens and the high beam output is greater than or equal to 1680 lumens; and
wherein the low illuminating beam output is greater than or equal to 530 lumens and the high illuminating beam output is greater than or equal to 780 lumens.

[c20] 20.The headlamp of claim 17, wherein the photoluminescent material comprises an organic fluorescent dye.

[c21] 21.The headlamp of claim 20, wherein the lens material further comprises a non-fluorescent dye.

[c22] 22.The headlamp of claim 21, wherein the fluorescent dye is included at a concentration of 0.0001 to 1 weight

% of fluorescent dye and the non-fluorescent dye is included at a concentration of 0.00001 to 0.1 weight % of non-fluorescent dye.

[c23] 23.The headlamp of claim 21, wherein the fluorescent dye is included at a concentration of 0.005 to 0.5 weight % of fluorescent dye and the non-fluorescent dye is included at a concentration of 0.0001 to 0.01 weight % of non-fluorescent dye.

[c24] 24.The headlamp of claim 21, wherein the fluorescent dye is included at a concentration of 0.01 to 0.25 weight % of fluorescent dye and the non-fluorescent dye is included at a concentration of 0.001 to 0.01 weight % of non-fluorescent dye.

[c25] 25.The headlamp of claim 20, wherein the fluorescent dye is selected from the group consisting of perylene derivatives, anthracene derivatives, benzoxazole derivatives, stilbene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphthalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, (2,5-bis[5-tert-butyl-2-benzoxazolyl]thiophene) and derivatives or combinations thereof.

[c26] 26.The headlamp of claim 1, wherein the lens has grooves or protrusions formed on a major surface

thereof, the major surface facing inwards toward the light source and the housing.

[c27] 27.The headlamp of claim 26, wherein the lens has an edge and an edge reflector, wherein the edge reflector covers at least a portion of the edge, whereby light conducted within the lens that reaches the edge and is reflected back into the lens.

[c28] 28.The headlamp of claim 27, wherein the photoluminescent material comprises an organic fluorescent dye.

[c29] 29.The headlamp of claim 28, wherein the lens material further comprises a non-fluorescent dye.

[c30] 30.The headlamp of claim 29, wherein the fluorescent dye is included at a concentration of 0.0001 to 1 weight % of fluorescent dye and the non-fluorescent dye is included at a concentration of 0.00001 to 0.1 weight % of non-fluorescent dye.

[c31] 31.The headlamp of claim 29, wherein the fluorescent dye is included at a concentration of 0.005 to 0.5 weight % of fluorescent dye and the non-fluorescent dye is included at a concentration of 0.0001 to 0.01 weight % of non-fluorescent dye.

[c32] 32.The headlamp of claim 29, wherein the fluorescent

dye is included at a concentration of 0.01 and 0.25 weight % of fluorescent dye and the non-fluorescent dye is included at a concentration of 0.001 and 0.01 weight % of non-fluorescent dye.

[c33] 33.The headlamp of claim 29, wherein the fluorescent dye produces a visual effect at an edge of the lens.

[c34] 34.The headlamp of claim 28, wherein the fluorescent dye is selected from the group consisting of perylene derivatives, anthracene derivatives, benzoxazole derivatives, stilbene derivatives, benzoxazole derivatives, stilbene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphthalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, (2,5-bis[5-tert-butyl-2-benzoxazolyl]thiophene) and derivatives thereof.

[c35] 35.The headlamp of claim 1, wherein an exterior surface of the lens is coated with a UV-coating.

[c36] 36.The headlamp of claim 35, wherein the photoluminescent material comprises an organic fluorescent dye.

[c37] 37.The headlamp of claim 36, wherein the lens material further comprises a non-fluorescent dye.

[c38] 38.The head lamp of claim 37, wherein the fluorescent

dye is included at a concentration of 0.0001 to 1 weight % of fluorescent dye and the non-fluorescent dye is included at a concentration of 0.00001 to 0.1 weight % of non-fluorescent dye.

[c39] 39.The head lamp of claim 37, wherein the fluorescent dye is included at a concentration of 0.005 to 0.5 weight % of fluorescent dye and the non-fluorescent dye is included at a concentration of 0.0001 to 0.01 weight % of non-fluorescent dye.

[c40] 40.The headlamp of claim 36, wherein the fluorescent dye is selected from the group consisting of perylene derivatives, anthracene derivatives, benzoxazole derivatives, stilbene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphthalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, (2,5-bis[5-tert-butyl-2-benzoxazolyl]thiophene) and derivatives thereof.

[c41] 41.The headlamp of claim 2, wherein the fluorescent dye has a quantum yield of 0.7 or greater.

[c42] 42.The headlamp of claim 38, wherein the fluorescent dye has a quantum yield of 0.9 or greater.

[c43] 43.A lens a molded body having a generally concave outer surface, a generally flat or convex inner surface

and an edge surface where, the molded body is formed from a composition comprising polycarbonate and a photoluminescent material, wherein the lens has grooves or protrusions formed on the inner surface, such that light that interacts with the photoluminescent material within the lens can escape from the lens through the grooves or protrusions.

[c44] 44.The lens of claim 43, wherein the photoluminescent material comprises an organic fluorescent dye.

[c45] 45.The lens of claim 44, wherein the lens material further comprises a non-fluorescent dye.

[c46] 46.The lens of claim 45, wherein the fluorescent dye is included at a concentration of 0.0001 to 1 weight % of fluorescent dye and the non-fluorescent dye is included at a concentration of 0.00001 to 0.1 weight % of non-fluorescent dye.

[c47] 47.The lens of claim 45, wherein the fluorescent dye is included at a concentration of 0.005 to 0.5 weight % of fluorescent dye and the non-fluorescent dye is included at a concentration of 0.0001 to 0.01 weight % of non-fluorescent dye.

[c48] 48.The lens of claim 45, wherein the fluorescent dye is included at a concentration of 0.01 and 0.25 weight % of

fluorescent dye and the non-fluorescent dye is included at a concentration of 0.001 and 0.01 weight % of non-fluorescent dye.

- [c49] 49.The lens of claim 44, wherein the fluorescent dye produces a visual effect at an edge of the lens.
- [c50] 50.The lens of claim 44, wherein the fluorescent dye is selected from the group consisting of perylene derivatives, anthracene derivatives, benzoxazole derivatives, stilbene derivatives, benzoxazole derivatives, stilbene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphthalimide derivatives, xanthenes, thioxanthenes, coumarins, rhodamines, (2,5-bis[5-tert-butyl-2-benzoxazolyl]thiophene) and derivatives thereof.
- [c51] 51.The lens of claim 43, wherein the lens further comprises an edge reflector, wherein the edge reflector covers at least a portion of the edge, whereby light conducted within the lens that reaches the edge is reflected back into the lens.
- [c52] 52.The lens of claim 51, wherein the photoluminescent material comprises an organic fluorescent dye.
- [c53] 53.The lens of claim 52, wherein the lens material further comprises a non-fluorescent dye.

- [c54] 54.The lens of claim 53, wherein the fluorescent dye is included at a concentration of 0.0001 to 1 weight % of fluorescent dye and the non-fluorescent dye is included at a concentration of 0.00001 to 0.1 weight % of non-fluorescent dye.
- [c55] 55.The lens of claim 53, wherein the fluorescent dye is included at a concentration of 0.005 to 0.5 weight % of fluorescent dye and the non-fluorescent dye is included at a concentration of 0.0001 to 0.01 weight % of non-fluorescent dye.
- [c56] 56.The lens of claim 53, wherein the fluorescent dye is included at a concentration of 0.01 and 0.25 weight % of fluorescent dye and the non-fluorescent dye is included at a concentration of 0.001 and 0.01 weight % of non-fluorescent dye.
- [c57] 57.The lens of claim 52 wherein the fluorescent dye produces a visual effect at an edge of the lens.
- [c58] 58.The lens of claim 52 wherein the fluorescent dye is selected from the group consisting of perylene derivatives, anthracene derivatives, benzoxazole derivatives, stilbene derivatives, benzoxazole derivatives, stilbene derivatives, indigoid and thioindigoid derivatives, imidazole derivatives, naphthalimide derivatives, xanthenes,

thioxanthenes, coumarins, rhodamines, (2,5-bis[5-tert-butyl-2-benzoxazolyl]thiophene) and derivatives thereof.

[c59] 59. A method for altering chromaticity of an automotive headlamp comprising the steps of, selecting a partial headlamp assembly comprising a light source and a housing, wherein the light source has a first chromaticity; selecting a lens comprising a polycarbonate and a fluorescent dye; and affixing the lens to the partial headlamp assembly thereby forming a headlamp assembly, such that light emitted from the light source passes through the lens to form an illuminating beam, wherein the composition of the lens is selected to modify the first chromaticity such that the illuminating beam has a second chromaticity that is different from the first chromaticity, and said second chromaticity has an average x chromaticity coordinate of 0.345 to 0.405.

[c60] 60. The method of claim 56 wherein the light source has an average x chromaticity coordinate greater than 0.405.